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REQ. NO. 9-9030

31 October 1979

CONTRACT REPORT NO. OSQ79-00075

Mr. J.M. Skeaff
Research Scientist
CANMET
555 Booth Street
Ottawa, Ontario
K1A 0G1

TITLE: PHYSICAL-CHEMICAL PROPERTIES OF $Ba/RaSO_4$ SLUDGES

Reference: 2085.1 Memorandum Number One

Dear Jim:

Enclosed is a copy of the data generated during the characterization and bench scale dewatering of $Ba\text{-}RaSO_4$ sludges in Elliot Lake between 9 October and 20 October, 1979. All previous results were forwarded to you on 28 September, 1979. These results are submitted in completion of DSS Contract No. OSQ79-00075.

The three sludges investigated were:

a) CANMET sludge,
b) Wastewater Pilot Plant sludge,
c) McLaren sludge.

A brief description of the physical characteristics is included below.

CANMET Sludge: The first sludge tested was the $Ba\text{-}RaSO_4$ sludge supplied by CANMET. The CANMET sludge was red-brown in colour, characteristic of a high iron sludge. Daily increases in solids concentration were observed as a result of difficulty in obtaining representative samples due to the presence of sand and gravel which settled between mixing and pouring of the sludge. The sludge dewatered moderately well but not as well as the Wasetewater Pilot Plant sludge. Sludge age, and the presence of sand, silt and organic matter may have adversely affected some of the tests.

89pp

.../2

Wastewater Pilot Plant Sludge: The Ba-$RaSO_4$ sludge of the Wastewater Pilot Plant sludge was collected daily from the recycle line on a thickener being used as a storage tank for the sludge. The pilot plant had not begun its demonstration phase when these tests began and as a result the sludge tested originated from previous pilot plant trials and was over a week old.

The sludge was red-brown in colour and seemed very consistent from day to day. Of the three sludges tested, the pilot plant sludge seemed to dewater the best. As in the case of the CANMET sludge, sludge age may have affected the dewaterability.

McLarens Sludge: Of the three sludges tested, the McLarens sludge proved to be the most difficult to dewater. For example, the time required to filter 10 milliliters of sludge for suspended solids analysis was in excess of 30 minutes. The pressure filter tests were discontinued after the first two test because of excessively long filtration times.

The sludge itself was a high Ra, low Ba sludge which was beige to brown in colour and inconsistent in solids concentration between sample buckets. The sludge contained granular particles which were brown, red and green in colour and varied in size from 1/8 to ¼ of an inch in diameter.

After settling for a period of two hours or more, a gel appeared on the surface of the sludge in which numerous red worms congregated. The worms (approximately one per square inch) were siphoned from the sludge each day before testing. Sand and small gravel also covered the bottom of the sample buckets.

All data generated was given to Herb Campbell in Burlington on 22 October so that he could begin data reduction. Please note that a corrected version of the 21 September, 1979 dry solids density calculation is included to update the data which you have already received. If you should require any additional information regarding the sludges, I would be pleased to discuss any aspect of this work with you.

Yours very truly

IEC INTERNATIONAL ENVIRONMENTAL CONSULTANTS LTD.

Jeffrey W. Pike

Jeffrey W. Pike
Senior Environmental Technologist

JWP/gt

Encl.

PLEASE REPLACE THIS PAGE IN CANMET RESULTS.

Dry Solids Density - CANMET SLUDGE - Sept 21, 79

1) TOTAL RESIDUAL SOLIDS =

$$\rho_S = \frac{0.997044^{*} \cdot 037443}{.037443 + 0.997044 - 1.0232}$$

$$\left[\rho_S\right] = 3.30755$$

* DENSITY AT 25°C.

C.S.T - CANMET

1) 22.3 Sec
2) 20.6 "
3) 21.6 "

} AVER 21.5 Sec

Inco Oct 9, 1979

Note: Demonstration phase has not yet begun with the contractor as agreed to. Last about mid October. Sludge used during the actual tests is being carried from the previously Inco recently modified by Lacey Whittle.

Since a method of obtaining sludge from the trucks is not yet ready the sample for Oct 9, 1979 was taken from the sludge line to the circulation tank between the tanks. The initial sludge sample (No 1) was considerably thicker than the second 2 l sample. Only the thicker sludge was used on Oct 9, 79.

Until test stage occurs we shall have to prepare an adequate method of collecting a sample.

Note: Density of Expansion + Dry Wt's already were supplied Oct 15, 79 using a representative sludge sample.

Day Mel Density

1) Tem Resonant Sounds

$\int_0^{\infty} S =$

Oct 10 '79

C.S.T.

1) 16.4 sec
2) 18.1 sec
3) 16.9 sec
4) 16.6 sec

AVE = 16.9 sec

Oct 10, 79

Tem Sounds

	Wavelength	Frequency	Time	# Sounds	$\bar{x}$
29 F	22.246	2.489	1.3459	7.4766	
30 F	22.235	2.0001	1.3331	7.7946	7.7961
31 F	21.8346	2.913	1.3332	8.1171	

Oct 10, 77

Specific Resistance – 8" Hg

CONDITIONING : NONE
FEED SOLIDS : 7.746 % total

9 cm dia · Whatman No. 1.
Volume of sludge : 200 mls
Wgt of sludge : 209.50 gms

CAKE ANALYSIS : IDENT ; I (022) TARE : 109.47
WET : 174.40
DRY : 124.88

CAKE THICKNESS : 0.85 cm % SOLIDS : 23.73

FILTRATE VISCOSITY no loo-MIBI, t = 65.3, 65.3, 65.3 } 20
(0.01521 centistokes/20)

t (min)	V (ml)	t/v ($\frac{sec}{ml}$)	t (min)	V (ml)	t/v ($\frac{sec}{ml}$)
0.5	46				
0.75	62				
1.00	72				
1.25	84				
1.5	93				
2.0	110				
2.5	125				
3.0	138				
3.30	144	∞ (a)			

McLAREN'S

Oct 10, 79

Single Reactor - 15" Hg

Conductivity Probe
Feed Solids: 7.796 ± %

Pan da Diatomaceous #1
Volume of sludge: ~2000 ml
Dry sludge: 208.12

Orr Washer's Invert: B-12
TRE : 109.72
WE : 16.150
DRY : 124.88
Orr Thickness: 0.8 cm. Solids: 26.24

Filtrate Viscosity: Ostwald-Fenske $t = \frac{(87)}{(83)} \eta_0$ 20°
(0.01627 centistokes/sec)

t(min)	V(ml)	% - (ml)
0	0	
0.25	32	
0.50	64	3.10 149
0.75	87	
1.00	831	
1.25	93	
1.50	1.4	
1.75	114	
2.00	120	
2.25	121	
2.5	126	
3.0	147	

Oct 10, 74

Apogee Resources - Rio Hy

Operation : None
Fluid Solids : 7.1961 %

Nordic Wireliner No 1
Volume of sample : ~2 cm³
Wgtg budget : 203.17

Core Analysis - Trust : I (B-31)
Tare : 109.65
Wet : 165.26
Dry : 124.23

Cake Thickness : 0.75 cm % Solids : 21.22 182/860 ✓

Fluids Viscosity ac-100-1131, L = ac-
(0.01627 centistokes/sec)

t (min)	V (ml)	% - (dial / tare)
:25	32	
:50	64	
:75	71	
1:00	96	
1:25	109	
1:50	120	
1:75	130	
2:00	131	
2:25	149	1" DROP

Oct 10, '79

Suction Pressure 25" Hg

Conditioning: None
Feed Solids: 1.79%-1%

9 cm Whatman No. 1.
Volume of sludge ~200 ml
Wt of sludge 208.21 gms

Cake Analysis: Trial 8 (8:35).
Tare: 102.37
Wet: 160.00
Dry: 117.38
Cake Thickness 0.7 cm % Solids: 24.05

Filtrate Vacuum No. 10-1131, t = (0.5)/(142) 655 sec
(a 0.5 ml pipette was used)

t (min.)	V (ml)
.25	36
.5	59
.75	75
1.00	88
1.50	111
1.71	122
2.00	130
2.25	138
2.56	149

Sample Reactor No. 1 8" Hg

Wt of WTC sludge + graduate	454.51
Wt of graduate	246.91
Wt of WTC sludge (gms)	207.60

Sample Reactor No 2 15" Hg

Wt of WTC sludge + graduate	455.39
Wt of graduate	247.27
Wt of WTC sludge (gms)	208.12

Sample Reactor No 3 22" Hg

Wt of WTC sludge + graduate	455.48
Wt of graduate	247.01
Wt of WTC sludge (gms)	208.47

Sample Reactor No 4 25" Hg

Wt of WTC sludge + graduate	454.89
Wt of graduate	246.38
Wt of WTC sludge (gms)	208.21

McLAREN'S

Oct- 10 79

Specific Resistance 23 "Hg.

Conditioning : Alum added 45 ml of 0.1%
Feed Solids 7.1%

Cell Whatman No. 1.
Volume of sludge ~ 200 ml
Wgt of sludge ? gms.

Cake Analysis : Test : 6 (B-34)
Tare : 102.43
Wet : 165.08
Dry : 116.91
Cake Thickness 0.75cm % Solids : 23.11

Filtrate Viscosity No 100 - M131 $t = \frac{66.2}{65}$ } 34 sec
(0.01527 centistokes / sec)

t (sec)	V (ml)
.25	26
.50	50
.75	76
1.00	98
1.25	102
1.50	113
1.75	123
2.00	132
2.25	141
2.25	141

Oct 10 79

Aqueous Reactor 22 hg

conditioning : 2.5 l/min of Aqueous HS | Pour Watman No 1
97.2% of 2.4 l/min | Volume of sludge = 200 ml
Total Solids : 7.796 l/To | Wgt of sludge 207.30 gms

Cake Analysis : Ignit : 9(3.2)
Tare : 103.13
Wet : 161.83
Dry : 117.16

Cake Thickness 0.7 cm % Solids : 23.90

Filtrate Viscosity % 100 = 1.131 $\mu = \frac{1.5}{2.1}\}63.7$ sec
(a other authorities / etc.)

C(mg/l) V(ml) % (sec/ml)

.25	42
.50	67
.75	84
1.00	99
1.25	111
1.50	122
1.75	132
2.00	142
2.18	149

Oct 10 79

Applied Vacuum -22 "Hg.

Condition: Soaked over night in Water of pH 7.1%
Feed Solids: 7.796 l

9 cm Whatman No. 1.
Volume of sludge ~ 200 ml
Wgt of sludge 203.54 gms.

Cake Moisture: Total = 2(B-6)
Wet = 109.33
Dry = 154.53
Dry = 124.06
Cake Thickness: 0.6 cm Solids = 23.57

Filtrate Viscosity @ 20 – 1131 $t = \frac{15\frac{3}{3}}{60}$ } 648 sec
(0.01527 centistokes/sec)

((Wet) − (Dry)) % = (Cake)

0	0
25	52
.5	84
.75	106
1.00	123
1.25	138
1.50	148
1.60	151

Spring Rentals No. 5

Wt of wire sludge + gradate	454.61
Wt of gradate	?
Wt of wire sludge	~252 mg

Spring Rentals No. 6

Wt of wire sludge + gradate	454.50
Wt of gradate	246.80
Wt of wire sludge	207.70

Spring Rentals No 7

Wt of wire sludge + gradate	452.93
Wt of gradate	249.39
Wt of wire sludge	203.54

Spring Rentals No 8

Wt of wire sludge + gradate
Wt of gradate
Wt of wire sludge

Oct 10, 79

Polymer - Nalco 6(7135) (Cationic)

conc used in Tests 0.4 g/L.

Stock soln for Sprague Resistance = 0.49/400 mL
(191 L)

1600 HRS - Oct 10, 79.

$$\frac{2.5 \text{ lbs}}{\text{ton}} \quad \frac{2.5 \text{ lbs of poly}}{\text{ton of dry solids}} \times \frac{454 \text{ gms}}{\text{lb poly}} \times \frac{1000 \text{ mls}}{\text{gm of poly}} \times$$

$$\Rightarrow \frac{1 \text{ ton of dry sol}}{2000 \text{ lbs dry sol}} \times \frac{1 \text{ lb}}{454 \text{ gms}} \times \frac{77.710 \text{ gms dry s}}{\text{L of sludge}}$$

$$= 97 \text{ mls / L of sludge}$$

$$5.0 \frac{\text{lbs}}{\text{ton}} = 194 \text{ mls / L of sludge}$$

$$7.5 \frac{\text{lbs}}{\text{ton}} = 291 \text{ mls / L of sludge}$$

$$10.0 \frac{\text{lbs}}{\text{ton}} = 388 \text{ mls / L of sludge}$$

$$1.0 \frac{\text{lbs}}{\text{ton}} = 38.8 \text{ mls / L of sludge}$$

Contraction Oct 11, 1979

Height of cake 1) 29.5 mm Contents Vol 1) 36.5 ml
2) 29.0 mm 2) 36.4 ml

Total Solids on Cake

Ident	Wet + Tare	Dry + Tare	Tare	% Solids	$\bar{x}$
36A	16.6355	4.6809	1.3600	21.7912	23.8018
36B	14.9110	4.8510	1.3508	25.8123	

Scrolled Tubes

Total Solids

Ident	Wet + Tare	Dry + Tare	Tare	% Solids	$\bar{x}$
38A	8.4863	2.1915	1.3669	11.5824	10.1450
38B	5.6153	1.7286	1.3617	8.7075	

Suspended Solids

Ident	Dry	Tare	Vol	% Solids	$\bar{x}$
66	.2432	.1312	10	1119	1620
6A	.3412	.1290	10	2122	

Oct 11, 1979

Total Solids

Trial	Tare + Wet	Tare + Dry	Tare	% Solids	$\bar{x}$
32A	22.1935	3.0466	1.3495	8.1419	8.1318%
35A	22.0435	3.0232	1.3473	8.1218	
34A	22.3528	3.0564	1.3926	8.1326	

NOTE: The solids measured on density toward the bottom of the centrifuge tubes (the heavier solids at the bottom are slightly or a few more than the solids closer to the interface.

Oct 11, 1979 Heavy Density

Initial conc — 1, 3, 5, 7, 9 % Sup. solids

Initial Conc (Suspended Solids) 7.77%.

After Settling & Counting — Sup. Conc.

IDENT	TARE + DRY	TARE	Volume	Solids	$\bar{x}$ (mg/l)
62	1.2254	.1231	10	109670	10.909%
63	1.2736	.1293	10	114430	
64	1.1612	.1296	10	103160	

To get X % solids - from conc. dilute y mls of 10.909 % solids to 1000 ml

9 %	825	$\left(\frac{9.0}{10.909} \times 1000\right)$
7 %	642	
5 %	458	
3 %	275	
1 %	91.7	

Note: Check conc. on 3 % + 1 % used to dilute samples.

		1015 OCT 13 RESUSP ENDED						1015 OCT 13 RESUSP. ENDED
INITIAL CONC.		9%	1%	3%	5%	7%	9%	5%
TIME INTVAL HRS	MIN							
0	0.0	1000	1000	1000	1000	1000	1000	1000
0	1.0		~900*	995	1000	1000	1000	
0	2.0		~740*	989	998	990	990	
0	4.0		~380*	978	995	978	980	
0	10.0	974	218	920	935	950	968	988
0	20.0	951	179	780	977	910	948	978
0	40.0		149	625	940	845	915	
1	00	892	134	550	916	799	890	935
1	30		120	482	879	745	859	
2	02	2 HRS 835	115	432	840	705	831	2 HRS 872
3	0	4 HRS 702	110	374	774	649	791	4 HRS 760
24	15		104	258	705	525	620	
			CRYSTAL CLEAR	CRYSTAL CLEAR	CRYSTAL CLEAR	CRYSTAL CLEAR	CRYSTAL CLEAR	
					ABOVE INTERFACE			
		891						560
7 HRS 30 MIN								
24	0 M	638						410

* INTERFACE NOT CLEAR

Oct 19, 1979. Expt. Date -

Initial Total Solids : 8.1318 %
Weighted Solids :

A) CONTROL

	Time (min)	Volume (ml)	Total Vol. (ml)	
11:25 AM	0	--		
	3.75	1 DROP	1 DROP	
	10.00	36.5	36.5	(SOLUTION SLIGHTLY CLOUDY)
	20.00	41.0	77.5	
	30.00	30.0	107.5	
	62.5	79.5	187.0	
	120.0	29.5	216.5	
	152	+2 ml	216.5 ml	
1:30		+2.5 ml	218 ml	

CAKE HEIGHT = 3.0 TO 3.6 cm

CAKE SOLIDS

TRIAL	WET WT	DRY WT	TIME	% S	$\bar{X}$
9 (6.75)	195.8g	119.55	103.25	17.37%	

Freeze thaw sample

Freezing began at 11:10 AM Oct 11, 79.

Instrument temp = -16.7 °C (of frame)

DATE:	TIME:	TEMP.
11:10 AM	0 HRS 0 MIN	15.5°C
Oct 11, 79	0 " 20'	12.8°C
	0 " 40'	9.7°C
	1 " 0 "	5.9°C
	1 " 30	2.2°C
	2 " 0 "	+0.1°C
	2 " 40 "	-0.3°C
	3 " 0 "	-0.5°C
	4 " 0 "	-0.2°C
	4 " 30 "	-0.2°C
0800 AM	----------	-15.2°C
Oct 12, 79		

Fraser Lake sample removed from freezer Oct 12, 79 @ 0715 pm (1915 HRS)

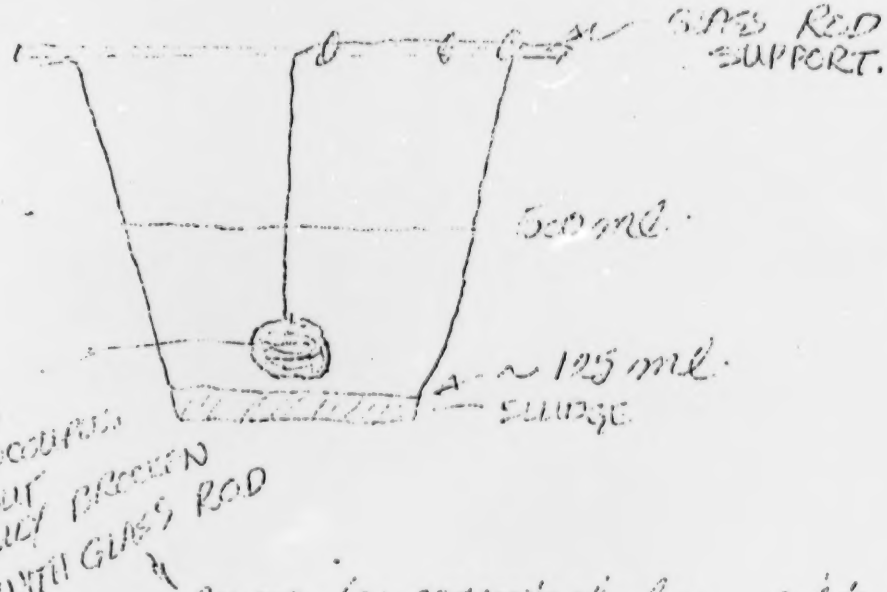
Time (2400) Dec.	Volume (mL)	Total Vol. (mL)
1800 HRS, Oct 13, 79		
15	144	144
30	92	236
45	50	286
60	13	299
10 MIN	22	321

Oct 13 @ 0830 HRS +1°C
" @ 1000 HRS +5°C
" " @ 1045 " +7°C
" " @ 1415 " +15°C
" @ 1755 " +17.5°C

CAKE Solids

IDENT	WET WT (gm)	DRY WT (gm)	TIME	% Solids	$\bar{x}$
9 (B-15)	161.24	125.22*	103.36	34.72%	

* VERY POWDERY, LIKE CHALK POWDER



Down to appear of fine silt like sludge, which blidgeon bottom a coarse. The ball remained as a ball on top of the settled sludge & was only dispersed by prodding with the glass rod until about 6 small "chunks" remained.

Colour is a darker red brown than water sludge.

Note: The sample was stirred prior to pouring However only the first poured out had most of the sludge back in the flask containing. Other samples was shaken into the same beds used as the take solids after 10min)

Oct 14, 79 Vacuum Filtration — 22" Hg

FILTER MEDIA : IY 527F FORM TIME : 58 Sec.
CYCLE TIME : 3 min DRY TIME : 40 Sec.

CAKE ANALYSIS: IDENT : 75
TARE : 102.45
TARE + WET : 175.51
TARE + DRY : 121.21
% SOLIDS : 25.68
CAKE THICKNESS : 0.5 to 0.6 cm.

FILTRATE VOLUME : 476 ml

SLUDGE SOLIDS

IDENT	TARE + WET	TARE + DRY	TARE	% SOLIDS (TOTAL)	$\bar{x}$
					8.1318%

FILTRATE SOLIDS

IDENT	TARE + DRY	TARE	VOL	SOLIDS	$\bar{x}$
67	.5133	0.1313	10	41,220	41220 mg/L
68	.5135	0.1313	10	41,220	

% RECOVERY :
YIELD :

Oct 14, 79. Vacuum Filtration.

FILTER MEDIA : NY 529F FORM TIME : 58.00.
CYCLE TIME : 3 min DRY TIME : 40.00.

CAKE ANALYSIS: IDENT : 2(B-31)
TARE : 109.40
TARE + WET : 179.35
TARE + DRY : 129.08
% SOLIDS: 28.13
CAKE THICKNESS: 0.660 cm

FILTRATE VOLUME : 308 ml

SLUDGE SOLIDS

IDENT	TARE + WET	TARE + DRY	TARE	% SOLIDS	$\bar{x}$
					8.1318%

FILTRATE SOLIDS

IDENT	TARE + DRY	TARE	Vol	SOLIDS	$\bar{x}$
69	0.2413	0.1307	10	11560	11510 mg/l
70	0.2347	0.1301	10	11460	

% RECOVERY :
YIELD :

McLAREN'S

Oct 12, 79 Vacuum Filtration

Filter Media : BIR 859. Form Time : 58 sec
Cake Time : 2 min. Dry Time : 40 sec.

Cake Analysis : Ident : 11 (B22)
Tare : 109.66
Tare + Wet : 176.07
Tare + Dry : 127.06
% Solids : 26.20
Cake Thickness : 0.6 cm

Filtrate Volume : 701 ml

Sludge Solids

Ident	Tare + Wet	Tare + Dry	Tare	% Solids	$\bar{x}$
39A	22.3991	3.0603	1.3849	7.9727	7.9770
40A	22.2829	3.0421	1.3813	7.9610	
41A	22.4095	3.0482	1.3587	7.9873	

Filtrate Solids

Ident	Tare + Dry	Tare	Vol	Solids	$\bar{x}$
74	.7047	0.1257	10	57,500	57150 mg/l
75	.6958	0.1253	10	56.00	

% Recovery :
Yield :

Oct 12, 79 Vacuum Filtration

FILTER MEDIA: PORE 853F FORM TIME: 58.00
CYCLE TIME: 5 min DRY TIME: 40.20

CAKE ANALYSIS: IDENT: 8 (B-35)
TARE: 102.47
TARE + WET: 172.43
TARE + DRY: 121.30
% SOLIDS: 26.90.
CAKE THICKNESS: 0.60 cm
0.65

FILTRATE VOLUME: 250 ml

SLUDGE SOLIDS

IDENT	TARE + WET	TARE + DRY	TARE	% SOLIDS

7.9.70

FEEDING SOLIDS

IDENT	TARE + DRY	TARE	VOL.	SOLIDS	%
76	.2602	0.1314	25	5152	5154
77	.2595	0.1306	25	5156	mg/L

% RECOVERY:
YIELD:

Oct-12, 79 Vacuum Filtration

Filter Media : PPR 851 Form Time : 58 sec
Cake Time : 3 min Dry Time : 40 sec

Cake Analysis : Ident : 6 (B-34)
Tare : 102.43
Tare + Wet : 171.06
Tare + Dry : 120.98
% Solids : 27.05
Cake Thickness : 0.6 cm.

Cloth may have leaked around edges?
Note: This run was repeated

Filtrate Volume : 2% ml

Sludge Solids

Ident	Tare + Wet	Tare + Dry	Tare	% Sol	x̄
					7.9770

Filtrate Solids

Ident	Tare + Dry	Tare	Vol	Solids	x̄
78	4.35	0.1506	25	10916	10828 mg/l
79	3.997	0.1512	25	10740	

% Recovery :
Visc :

Oct 12, 79 Vacuum Filtration

Filter Media: PPR 861 Form Time: 19 sec.
Cycle Time: 1 min. Dry Time: 13 sec.

Cake Analysis: Ident: B-12
Tare: 110.11
Tare + Wet: 148.24
Tare + Dry: 120.91
% Solids: 28.32
Cake Thickness: 0.3 cm

Cloth tightened still may have leaked.

Filtrate Vol: 150 ml

Sludge Solids

Ident	Tare + Wet	Tare + Dry	Tare	% Solids	$\bar{x}$

7.9770

Filtrate Solids

Ident	Tare + Dry	Tare	Vol	Solids	$\bar{x}$
80	.4486	.1301	25	12740	12692
81	.4457	.1276	25	12644	12692 mg/l

% Recovery:
Yield:

Oct 12, 79 Vacuum filtration.

Filter Media : Rpr 851 Form Time : 96 sec
Cycle Time : 5 min Dry Time : 67 sec.

Cake Analysis : Ident : 2(B-9)
Tare : 10.949
Tare + wet : 18.92
Tare + dry : 13.50
% Solids : 28.48
Cake Thickness : 0.70-0.75 cm

OK

Filtrate Volume : 346 ml

Sludge Solids

Ident	Tare + wet	Tare + dry	Tare	% Sol	$\bar{x}$
42A	22.3652	2.9473	1.3534	7.5857	7.5876%
43A	22.4727	2.9576	1.3565	7.5931	
44A	22.7127	2.9789	1.3595	7.5834	

Filtrate Solids

Ident	Tare + dry	Tare	Vol	Solids	$\bar{x}$
85	.2859	.1319	25	6160	6158 mg/l
86	.2843	.1304	25	6156	

% Recovery :
Yield :

Oct 12, 79 Vacuum Filtration

FILTER MEDIA : POPR 851 FORM TIME : 58 s
CYCLE TIME : 3 min DRY TIME : 40 s

CAKE ANALYSIS : IDENT : 9-(B-15
TARE : 103.39
TARE+WET : 163.98
TARE+DRY : 120.58
% SOLIDS : 28.37
CAKE-THICKNESS : 0.55 cm

FILTRATE VOLUME : 244 ml

NOTE ON VACUUM FILTRATION RUNS — cake cracked and fell off filter cloth by the end of the drying time so it was easily removed. Cake began to crack after 10 seconds into the dry time.

FEED SOLIDS — 1.5376 %.

FILTRATE SOLIDS

IDENT	TARE+DRY	TARE	VOL	SOLIDS	$\bar{x}$
89	.2221	.1328	25	3572	3564
90	.2202	.1313	25	3556	mg/l

% Recovery :
Yield :

McLAREN'S

Oct 12, 79. FLOC STRENGTH. - VACUUM FILTER.

FILTER MEDIA : PONR 851 FORM TIME : 58 sec.
CYCLE TIME : 3 min DRY TIME : 110 sec.

CAKE ANALYSIS : IDENT : 7(B-3)
TARE : 109.86
TARE + WET : 158.85
TARE + DRY : 124.31
% SOLIDS : 29.50
CAKE THICKNESS : 4 to 5 cm

FILTRATE VOLUME : 226 mls.

SLUDGE SOLIDS

IDENT	TARE + WET	TARE + DRY	TARE	% SOLIDS	$\bar{x}$
					7.5876%

FILTRATE SOLIDS

IDENT	TARE + DRY	TARE	VOLUME	TSS	$\bar{x}$
87	.2816	1802	25	5576	5586 mg/l
88	.2723	.1804	25	5596	

A 2 L SAMPLE WAS STIRRED FOR 10 MIN PRIOR TO FILTERING, BUCHNER FUNNELS 4 CUT.

Oct 12, 79 — FLOC STRENGTH — BUCHNER FUNNEL

CONDITIONING : SHEARED
FLOC SOLIDS : 7.3576 %

" Hg - 9 cm DIA. WHATMAN #1
Appx Vol. of Sludge - 200
25" Hg

Wgt of WTC sludge + graduate.	453.19
Wgt of graduate after pouring sludge	244.82
Wgt of WTC sludge.	208.37 gm

CAKE ANALYSIS : TIN : 75
WET : 102.52
TIN + DRY : 157.07
TIN + DRY : 116.49
% SOLIDS : 25.61

CAKE THICKNESS : .6 / 10.7 cm

FILTRATE VISCOSITY : 1/0 100 MISI t = 64.3 / 160.4 220.

t (min)	V (ml)	t/v ($\frac{sec}{ml}$)
.25	50	
.50	50	
.75	77	
1.00	90	
1.25	103	
1.50	114	
1.75	124	
2.00	133	
2.25	142	
2.47	150	

CLARENS

Oct 12.79. FLOC STRENGTH

C.S.T Initial Prior to Shearing

1) 16.2
2) 17.1
3) 15.7
} 16.3 dec

C.S.T. After Shearing

1) 18.6
2) 18.4
3) 18.2
} 18.4 dec

Oct 13, 79 — Pressure Filter

FILTER MEDIA : NY 5271
PRESURE : 75 psig.

FILTRATE FLOW

A) TIME (min)	B) VOL (cc)	C) TOTAL (ml)
0	13	18
~.5	~100	100 *
1.00	~29	129
2.00	60	160
3.00	86	186
4.00	106	206
5.00	124	224
7.50	162	262
12.50	228	328
14.75	250	350
26.00	91	441
30	127	477
45	223	573
49.50	250	600
58.1	73	673 FIN.

CAKE MUST HAVE BROKEN. VERY HIGH SOLIDS AT END.

NOTE: IT DID BREAK DOWN THE CAKE OF THE PRES FILTER

* 100 ml was through before 75 psig was reached - (it should have brought more fast at first)

FILTRATE SOLIDS - least 100 ml

IDENT	TARE/DRY	TARE	VOL	TSS (mg/L)
91	.7263	.1215	10	59,880.

FILTRATE VOLUME - REMAINDER

IDENT	TARE+DRY	TARE	VOL	TSS (mg/L)
95	.1740	.1278	25	1848

FILTRATE VOL - COMBINED

96	.3764	.1278	100	2486

CAKE SOLIDS

IDENT : 11 (B22)
TARE : 109.84
TARE+WET : 462.57
TARE+DRY : 182.52
% SOLIDS : 24.55
CAKE THICKNESS : cm

Feed Solids - Tons

45A	22.0068	3.2906	1.3616	9.3463	9.3701
46A	22.0247	3.2984	1.3814	9.3820	
47A	21.8209	3.2713	1.3516	9.3839	

Oct 13, 79 — Pressure Filter

FILTER MEDIA : NY 529F
PRESSURE : 75 psig

FILTRATE FLOW

TIME	VOL.	TOTAL VOL.	TIME	VOL.	TOTAL VOL
0	28				
1	87				
1.59	100	100			
6.00	87	187			
10.00	145	243			
15.00	200	300			
19.60	250	350			
30.00	89	1149			
40.00	155	565			
50.00	214	564			
56.60	250	600			
60.00	17	617			
65.10	60	660			

FILTRATE SOLIDS - first 100 mls - dup

IDENT	TARE + DRY	TARE	VOL	TSS (mg/L)
97	1310	1291	50	38

Filtrate Solids – remainder - crystal clear. Heat for small vol at end of run.

IDENT	TARE + DRY	TARE	Vol	TSS (mg/L)
98	.1295	.1287	100	8

FILTRATE SOLIDS – combined

99	.1332	.1291	500	8.2

CAKE SOLIDS: IDENT: 3(B-35)
TARE: 102.47
TARE + WET: 223.98
TARE + DRY: 135.84
% SOLIDS: 26.38

McLAREN'S

Oct 13, 79 — Pressure Filter

Filter Media: Pork 8531
Pressure : 0-75 PSIG

Marine Pond

Time	Vol	Total Vol.	Time	Vol	Total Vol.
0	15	15			
.5	52	52			
1.84	100	100			
5.00	65	165			
10.00	137	237			
15.00	194	294			
20.88	256	350			
30.00	73	423			
40.00	141	491			
50.00	201	551			
58.70	250	600			
63.82	42	642			

Marine Sample - post media - slight red yellow precipitate

Dent	Time (day)	Tare	Vol.	TSS (mg/L)
100	.1381	.1201	25	820

FILTRATE SOLIDS - Secondary crystal clear except last few mls

IDENT	TARE/DRY	TARE Vol.	TSS (mg/l)
101	.1331	.1312 100	19

FILTRATE SOLIDS — continued.

102	.1431	.1339 250	56.8

CAKE SOLIDS : IDENT : 75
TARE : 102.51
TARE + WET : 218.06
TARE + DRY : 132.70
% SOLIDS : 26.13

MCLAREN'S

Oct 13, 74 — Pressure Filter

FILTER MEDIA: ORNIRS
PRESSURE : 75 psig

FILTRATE FLOW

TIME	VOL	TOTAL VOL	TIME	VOL.	TOTAL VOL
0	0	0			
.5	50	50			
1.70	100	100			
5.00	78	178			
10.00	155	255			
15.00	214	314			
18.55	250	350			
30.00	97	447			
53.30	250	600			
62.21	69	669			

NOTE: NO FLOW UNTIL PRES WAS APPLIED.

FILTRATE SOLIDS — from 100 ml

IDENT	TARE + DRY	TARE	VOL	TSS (mg/l)
103	.1301	.1258	25	52.

Filtrate Solids - continued

Ident	Tare+Dry	Tare	Vol.	TSS (mg/l)
104	.1299	.1291	100	8

Filtrate Solids - continued.

105	.1322	.1295	500.	5.4

Cake Solids : Ident : B-12
Tare : 110.10
Tare + Wet : 235.90
Tare + Dry : 141.71
% Solids : 25.13

Note: Cake & carrot easily separated. However carrot is much darker in color than NY or PBR.

McLAREN'S

Oct 14, 79 Gravure Fifteen

FILTER MEDIA: BPR 851
PRESSURE : 75 psig

FILTRATE FLOW

TIME	VOL	TOTAL VOL	TIME	VOL	TOTAL VOL.
0	13	13			
.5	50	50			
1.0	72	72			
1.91	100	100			
5.00	60	160			
10.00	130	290			
15.00	133	293			
20.00	229	329			
		350			
30.00	53	403			
45.00	143	498			
64.10	250	600			
69.59	43	643 end			

FILTRATE COLORS - first 100 mls opaque yellow w/ yellow in color

IRON	TIRON DRY	TIRE	VOL	TSS (mg/l)
109	.1316	.1293	25	92

FILTRATE Solids - remainder - crystal clear until very end.

IDENT	TARE + DRY	TARE	Vol	TSS (mg/L)
110	.1207	.1202	100	5

FILTRATE SOLIDS -

141	.1357	.1282	500	15.

CAKE Solids : IDENT : 6 (B-34)
TARE : 102.43
TARE + WET : 244.43
TARE + DRY : 127.0
% Solids : 24.98

FEED Solids

48A	22.0259	3.3221	1.3596	9.4961	9.5463
49A	21.8707	3.3180	1.3589	9.5511	
50A	22.2286	3.3601	1.3583	9.5417	

McLAREN'S

Oct 14, 79 — Pressure Filter

Filter Media : PoPR 851
Press : 100 psig

Filtrate Flow

Time (min)	Vol (ml)	Total Vol ml)	Time	Vol	Total Vol.
0	~10	~10	64.96	51	651
1.00	72	72			
1.85	100	100			
5.06	70	170			
10.00	142	242			
15.00	197	297			
20.70	250	350			
35.00	107	457			
45.00	171	521			
58.95	250	600			
62.00	18	618			
64.00	31	631			

Filtrate Solids -- first 100 ml - opaque yellow ppt color

Ident	Time + Dry	Time	Vol	TSS (mg/l)
111	.1325	.1295	25	120

FILTRATE SOLIDS – remainder – crystal clear umbrella

IDENT	TARE + DRY	TARE	Vol	TSS (mg/L)
112	.1297	.1288	100	9

FILTRATE SOLIDS – combined

113	.1341	.1306	500	17

CAKE SOLIDS : IDENT : 2(B-31)
TARE : 109.46
TARE + WET : 260.48
TARE + DRY : 145.79
% SOLIDS : 24.06

MCLARENS

Oct 14, 79 Pressure Filter

Filter Media: Rare 851
Press : 50 psig

FILTRATE FLOW

TIME (min)	Vol (ml)	Total Vol (ml)	TIME	Vol	Total Vol.
0	~8	~8			
.5	44	41			
1.00	65	65			
2.14	100	100	63.60	250	600
5.00	59	159	66.70	37	637
10.00	130	230			
15.00	183	233			
20.00	229	329			
22.65	250	350			
30.00	54	404			
45.00	149	499			
60.00	231	571			

NOTE INITIAL SHOT VERY HIGH IN SOLIDS. LITTLE CLEARING OF FILT. UNTIL ALMOST 100 ml

FILTRATE Solids - first 100 ml

IDENT	TARE + DS	TARE	Vol	TSS (mg/l)
114	.1533	.1293	25	960

FILTRATE SOLIDS – remainder

IDENT	TARE + DRY	TARE	VOL.	SOLIDS	%
115	.1533	1304	100	31	

FILTRATE SOLIDS – combined

116	.1688	.1286	250	161	

CAKE ANALYSIS : IDENT : B-33
TARE : 103 41
TARE + WET :
TARE + DRY : 137.76
% SOLIDS :

? 174.00 I believe

JP

McLAREN'S

Oct 14, 79

Density of Suspension

Total Solids

Ident	Tare + Dry	Tare	Vol.	Solids	$\bar{x}$.
51A	2.4159	1.3581	10	105780	105140
52A	2.4096	1.3579	10	105170	
53A	2.3968	1.3521	10	104470	

Bottle Ident	Tare (gms)	Tare + Dist (gms)
172	261.00	562.79
193	258.11	560.27
328	258.90	563.01

Temp. of distilled = 16.8°C

WTC	Sludge
172	558.17
193	582.10
328	585.55

WTC Sludge

The WTC sludge was a red brown sludge of high consistancy when filtered reasonably well.

During the filter leaf, the sludge caked well & dryed to the point of cracking ~10 seconds into the drying cycle.

The sludge poured like a liquid plastic and seemed to be uniform in particle size & colour.

Solids

	TOTAL	SUSPENDED
Oct 10, 79	7.7961 %	77710 mg/l
" 11, " .	8.1318	81417 *
" 12, " .	7.9770	79703
" 12, " .	7.5876	75240
" 13, " .	9.3101	95570 *
" 14, " .	9.5163	97597 *

* susp solids slightly > Total solids.

McLAREN'S

Initial Notes on McKaren Sludge.

Duncan Moffett drained one of the two McKaren ponds by appr. 3 feet so as to get a representative sample. At noon Oct 15, I secured six pails of sludge (1 gal pails). The sludge contains small pebbles (appr 1/4" or smaller) in the Ba-Ka sludge. (Was a 1/2" pebble on one pail.)

Duncan is concerned that I use extreme caution with the sludge as it is a low-Ba, high Ra sludge. It is actively producing radon gas & must only be opened in the fume hood. Duncan says this sludge is far, far more dangerous than any previous the sludges analyzed.

Duncan said me to let the sludge set overnight & then we must store the samples for 21 days.

Oct 16, 79

Sludge No. 3. McLaren sludge.

Total Solids

Ident	Tare + Dry	Tare	Vol	% Solids	$\bar{x}$
54A	1.7940	1.3536	10	44040	43540
55A	1.7934	1.3627	10	43570	
56A	1.7813	1.3512	10	43010	

Suspended Solids

Ident	Tare + Dry	Tare	Vol	% Solids	$\bar{x}$
117			25	– would not filter	
118	.6029	0.1294	10	39,350	39,463
119	.6030	0.1295	10	39350	
120	.5869	0.1300	10	39690	

– time 20 min to filter with one rinse

Total Solids

Ident	Tare + Wet	Tare + Dry	Tare	% Sol.	$\bar{x}$
57A	18.1506	2.0859	1.3501	4.1700	4.1875
58A	20.4834	2.1594	1.3510	4.2258	
59A	20.0477	2.1321	1.3538	4.1667	

Density of Sediment:

Bottle Identification	Tare (gms)	Tare + Dist (gms)	Tare + Sludge (gms)
172	260.97	562.89	572.24
193	258.09	560.34	569.71
328	258.89	563.06	572.47

Temp. of distilled water = 16.0°C.

Bottle Volumes:

Oct 16, 79

Capillary Suction Time

1) 34.3 sec.
2) 36.4 sec.
3) 35.7 sec

AVER. CST = 35.5 sec.

Oct 16, 79 Specific Resistance - 8 "Hg

CONDITIONING - NONE
FEED SOLIDS -

9 cm diameter Whatman No 1.
Volume of sludge - 200 ml.
Wgt. of sludge - 208.91 gms

CAKE ANALYSIS: IDENT : 8(B-35) TARE : 102.46
WET : 148.88
DRY : 110.25
CAKE THICKNESS: 0.5 cm % SOLIDS: 16.78

FILTRATE VISCOSITY No 100-M131 t = 1) 46.0 sec
(0.01527 centistokes) 2) 44.8 sec
3) — sec

t (min)	V (ml)	t/v ($\frac{sec}{ml}$)	t	V	t/v.
0.5	16		35.0	150	
1.5	31		39.60	156	
2.5	41		Filter Drop		
5.0	59				
7.5	75				
10.0	85				
15.0	104				
17.5	114				
20.0	121				
22.5	128				
25.0	134				
30.0	143				

Oct 16, 79 Specific Resistance – 15" Hg

CONDITIONING : NONE
FEED SOLIDS :

9 cm diameter Whatman #1
APPR Vol. of sludge - 200 ml
Wgt. of sludge - 202.81 gms.

CAKE ANALYSIS: IDENT : 11 (B-22)
TARE : 109.63
TARE + WET : 150.63
TARE + DRY : 117.41
% SOLIDS : 18.98

CAKE THICKNESS. 05 cm

FILTRATE VISCOSITY 70/100 – M131 t = 1) 69.4 sec
2) 69.8 sec

t (min)	V (ml)	$\frac{t}{v}$ $\left(\frac{sec}{ml}\right)$
0.5	15	
1.5	35	
2.5	45	
5.0	65	
10.00	94	
15.00	116	
20.00	133	
27.5	151	
30.00	165	
33.17	160	1" Hg, 120

Oct 16, 79 Sprague Resistance - 22" Hg.

CONDITIONING : None
FEED SOLIDS : 9 cm diameter Whatman #1. One vol of sludge - 200 and dry of sludge 0.288 gms.

CAKE ANALYSIS : TDENT = 4(B 15)
TARE = 103.39
TARE + WET = 143.98
TARE + DRY = 110.09
% SOLIDS = 16.51

CAKE THICKNESS : 5.6 cm.

FILTRATE VISCOSITY .10 100 - 1.1081 t = 1) 69.4 s
2) 66.0 s.

t (min)	V (ml)
0.5	19
1.5	35
2.5	46
5.0	67
7.5	83
10.0	96
12.5	108
15.0	119
20.0	137
22.5	144
25.0	150
27.5	156
30.04	160 - 1" Bub. Point

Oct 16, 79 Sprague Resistance

CONDITIONING : NONE
FEED SOLIDS :

9 cm Whatman No 1.
Alk Vol of sludge = 200ml
Wgt of Sludge = 203.84 gms

CAKE ANALYSIS :

IDENT : 2 (6-9)
TARE : 109.45
TARE + WET : 149.52
TARE + DRY : 117.39
% SOLIDS = 19.76

CAKE THICKNESS = 0.5 cm

FILTRATE VISCOSITY @ 100 - MIBK

$t = \begin{cases} 60.3 \text{ s} \\ 62.5 \text{ s} \end{cases}$ Av.

t (min)	V (ml)	γ_r ($\frac{sec}{ml}$)
0.5	20	
1.5	37	
2.5	49	
5.0	70	
10.0	101	
15.0	124	
20.00	143	
25.00	159	
27.5	162	

1st Run Out

Specific Resistance No 1

Wgt of M°L sludge + graduate	449.29
Wgt of graduate	246.38
Wgt of M°L sludge (gms)	202.91

Specific Resistance No 2.

Wgt of M°L sludge + graduate	449.26
Wgt of graduate	246.45
Wgt of M°L sludge (gms)	202.81

Specific Resistance No. 3.

Wgt of M°L sludge + graduate	449.79
Wgt of graduate	246.91
Wgt of M°L sludge (gms)	202.88

Specific Resistance No 4.

Wgt of M°L sludge + graduate	449.44
Wgt of graduate	246.40
Wgt of M°L sludge (gms)	203.04

Oct 16, 79.

Polymer - Spraek Aquafloc 6465

Stock solution for Surface Loadings (1gm/l)

$$1.0 \frac{lbs}{ton} = \frac{10 \text{ lb} \times 454 \times 100 \times 39.463}{ton \quad 2000 \times 454}$$

$= 19.73$ mL 0.1% AQUAFLOC 6465 / l

$2.5 \frac{lbs}{ton} = 49.33$ mL " " " / l

$5.0 \frac{lbs}{ton} = 98.66$ " " " / l.

Oct 16, 79 Specific Resistance.

CONDITIONING: 1.46 l/ten Polymer 465 Jar Watman
19.73 mls of 0.1% I and Volume of sludge ~ 200 ml
FEED SOLIDS: wt of sludge 201.65 gms

CAKE ANALYSIS

DENT: 75.
TARE: 102.51
TARE WET: 143.60
TARE DRY: 110.24
% SOLIDS: 18.81

CAKE THICKNESS Hfo .53 cm
Mg -.5

FILTRATE VISCOSITY 20-100-1131 t = 624 sec
603 sec.

t (min)	V (ml)	t/v (sec/ml)
0.50	21	
1.50	38	
2.50	51	
5.00	75	
10.00	103	
15.00	120	
20.00	141	
25.00	159	
25.5	160	

1 Hg Dep

Oct 16, 79 Specific Resistance

CONDITIONING: 2-5 lb/ton FLOPAM AN 125
4133 mls of 0.1% /l.

FEED SOLIDS:

9 cm Whatman #1
Vol. of sludge ~ 200 ml
Wgt of sludge — gms.

CAKE ANALYSIS

IDENT: B-12
TARE: 110.12
TARE + WET: 149.46
TARE + DRY: 117.70
% SOLIDS: 19.27

CAKE THICKNESS .4 to .6 cm.

FILTRATE Viscosity mu 100 - MIBK (1-1) 1) 63.7 cs
2) 60.4 cs

t (min)	V (cc)	t/v - (sec/cc)
.50	26	
1.00	48	
2.50	63	
5.00	91	
10.00	126	
15.00	147	
20.00	160	

1st by DROP

Oct 16, '79 - Specific Resistance

CONDITIONING: 5.0 dose/ton ASFL 465
9816 mls of 0.1% P/L
FEED SOLIDS %

2 cm dia Whatman #1
Vol. of sludge = ~50 cm.
Wgt of sludge 201.08 gms.

CAKE ANALYSIS:

IDENT: 7(B-31)
TARE: 109.85
TARE + WET: 156.89
TARE + DRY: 116.17
% SOLIDS 13.44

CAKE THICKNESS 4 to .5 cm

FILTRATE VISCOSITY 100-M131 t = 61.5 sec.
= 60.2 sec.

X (min)	V (ml)	Y = (sec/ml)
.25	44	
.6	66	
.75	84	
1.00	97	
1.25	105	
1.50	112	
2.00	121	
2.50	128	
3.00	134	
3.50	138	
4.00	142	
5.00	147 (8)!	
6.00	151	
6.36	153	
1st Drop		

2 worms in cake.

Specific Resistance No 5

Wgt of sludge + graduate	448.65
Wgt of graduate	241.00
Wgt of M.L. sludge (gms)	201.65

Specific Resistance No 6.

Wgt of M.L sludge + graduate	449.54
Wgt of graduate	?
Wgt of M.L. sludge (gms)	SORRY

Specific Resistance No 7

Wgt of M.L sludge + graduate	449.66
Wgt of graduate	248.58
Wgt of M.L sludge (gms)	201.08

Centrifugation

Oct 17, 79

Height of Cake 1) 42 mm Cent. Vol. 1) 30.5 ml *
2) 42 mm 2) 30.5 ml) *

* Time SS still in centrate

Total Solids on Cake.

Ident	Tare + Wet (gms)	Tare + Dry (gms)	- Tare (gms)	% Solids	$\bar{x}$
63A	20.4850	3.7632	1.3514	12.6051	
64A		3.8226	1.3528		

Scrolled Solids.

Total.

Ident	Tare + Wet (gms)	Tare + Dry (gms)	- Tare (gms)	% Solids	$\bar{x}$
65A	13.1956	2.1114	1.3551	6.3874	6.6852
66A	16.4085	1.9946	1.3623	6.9830	

Suspended Solids

Ident	Tare + Dry	Tare	Vol	Solids	$\bar{x}$
124	.2428	.1293	10 ml	11.350	15,305
125	.3210	.1284	10 ml	19.260	

Oct 17, 79

Total Solids

IDENT	TARE+WET	TARE+DRY	TARE	%SOLIDS	$\bar{x}$
60A	21.7348	2.4345	1.3508	5.3151	5.3687
61A	21.6280	2.4313	1.3528	5.3193	
62A	21.8159	2.4691	1.3492	5.4718	

+ - just to note after weighing solids above I added solids on bottom. I may have sucked up surface solids with the wad.

Oct , 79 Gravity Thickening

Initial conc — 1, 3, 5, 7, 9% Sup solids.

Initial conc. —

After settling 4 days — Sup conc.

Dish't	Tare + Dry	Tare	Vol	Solids	X
144	.5558	0.1299	10	~~4259~~	
145	.6491	0.1286	10	520.50	50120
146	.6215	0.1276	10	4939.0	

To get X % solids from conc.

Divide y mls of thickened sludge to 1000 mls

9 %

7 %

5 %

3 %

1 %

986 - 5 / 5.0120 x1000

.591

197

INITIAL CONC.

TIME:	HRS	MIN	1%	3%	5%	7%	9%
OCT 18	0	0	1000	1000	1000		
	0	5	590	995	999		
	0	20	599	975	995		
	0	30	495	959	995		
	0	50	380	919	990		
	1	0	349	902	988		
	1	20	320	858	983		
	1	40	302	799	979		
	2	0	288	770	977		
	4	30	249	684	959		
	6	0	240	660	946		
	18	0	228	585	873		
	24	0	224	576	860		

Oct 17, 79 Freeze Thaw

Initial Total Solids:
Suspended Sx:

H) CONTROL

Time (min)	Vol. (ml)	Total Vol. (ml)	
0	0	0	← OCT 17, 1030 AM
15.1	1ST DROP		
30.00	20.5	20.5	
90.00	61.0	81.5	
150	42.5	124	
240	38	162	
330	17	179	
450	8	187	
	8	195	← OCT 18, 0815 AM

OC

C

CAKE Solids

IDENT	TARE + WET	TARE + DRY	TARE	% SOLIDS
7(B-31)	179.26	117.43	104.85	10.92%

HARD CAKE, LIKE CLAY

FREEZE THAW SAMPLS

Freezing began at 10:30, Oct 17, 79

Freeze temp. -17°C.

DATE:	TIME:	TEMP. OF SAMPLE -
CT 17,79	10:30 AM	15°C
	11:00 AM	13.1°C
	12:00 pm	3.2°C
	1:00 pm	0.0°C
	2:30 pm	-0.2°C
	4:00 pm	-0.2°C
	6:00 pm	-0.2°C
	7:30 pm	-0.2°C
OCT 18,79	0745 AM	-15.2°C

* at 2:30pm no visual sign of ice, sludge occupies < 100 ml on the bottom of the plastic container.

Note: liquid above sludge was clear prior to mixing & pouring of the sample. The filtrate which passed through the bed is extremely turbid (muddy) and cannot be seen through.

Lake on sand bed is like beach sand, brown & granular & damp wet.

Forge Hour sample removed from Freezer
@ 0830 HRS Oct 18, 79

0830	OCT 18, 79	−15.2
0000	" " "	− 0.0
11:30		+ 0.2
12:30 pm	" "	+ 0.9
1:30 pm	" "	+ 6.2
2:00 pm	" "	+12.1
2:30 pm		+15.9 − *
3:30 pm		+20.0°C

Pouring sludge on sand bed.

	Vol	Total Vol
After 15 sec	210	210
After 30 sec	105	315
After 60 sec	24	339
After 10 min	11	450

See NOTE NEXT PAGE.

CAKE Solids

IDENT	TARE + WET	TARE + DRY	TARE	% Solids.
8(B-35)	147.91	117.81*	102.47	33.76 %

* very powdery

* at 2:30pm no visual sign of ice, sludge occupies < 100 mls on the bottom of the plastic container.

Note: liquid above sludge was clear prior to mixing + pouring of the sample. The filtrate which passed through the bed is extremely turbid (muddy) and cannot be seen through.

Lake on sand bed is like beach sand, brown + granular + damp wet.

Oct-17, '79 Vacuum Filtration 22" Hg.

FILTER MEDIA: NY 527F
CYCLE TIME: 3 min.

FORM TIME: 58 sec
DRY TIME: 40 sec

CAKE ANALYSIS

IDENT: 2(B-31)
TARE: 109.46
TARE + WET: 133.79
TARE + DRY: 112.95
% SOLIDS: 14.34

CAKE THICKNESS: .2" - .3 cm - A NOT REALLY A CAKE, MORE LIKE A THICK PASTE.

FILTRATE VOLUME: 133 ml

SLUDGE SOLIDS

IDENT	TARE + WET	TARE + DRY	TARE	% SOLIDS	$\bar{x}$
					5.3687

FILTRATE SOLIDS

IDENT	TARE + DRY	TARE	VOLUME	SOLIDS	$\bar{x}$
126	.3422	.1314	10 *	21080	21115 mg/l
127	.3413	.1298	10 *	21150	

% Recovery
YIELD

* Very fine solids & very hard to filter.

Oct 17, 79 Vacuum Filtration - .22"Hg

Fiber Media: NY529F. Form Time: 58 sec
Cycle Time: 3 min. Dry Time: 40 sec.

Cake Analysis

Ident: 6 (6-34)
Tare: 102.42
Tare + Wet: 122.56
Tare + Dry: 105.42
% Solids: 14.68

Cake Thickness: 1.25 cm

Filtrate Volume: 100 mls.

Sludge Solids

5-3687

Filtrate Solids

Ident	Tare + Dry	Tare	Volume	Solids	%
128	.1496	.1295	2	940	965 mg/l
129	.1495	.1307	2	940	

% Recovery
Yield

Oct 17, 79 Vacuum Filtration - 22" Hg.

FILTER MEDIA : RPP 859 FORM TIME : 58 sec.
CYCLE TIME : 3 min. DRY TIME : 40 " .

CAKE ANALYSIS:

IDENT : B-33
TARE : 103.41
TARE + WET : 124.81
TARE + DRY : 106.16

CAKE THICKNESS : 0.2 cm % SOLIDS : 12.85

Filtrate Volume : 90 ml.

Sludge Solids

5.3687

Filtrate Solids

IDENT	TARE + DRY	TARE	VOLUME	SOLIDS	$\bar{x}$
190	.2421	.1256	10	1616.0	1627.5
191	.2930	.1291	10	1639.0	mg/l

% Recovery :
YIELD :

Oct 17, 79 Vacuum Filtration - 22" Hg

FILTER MEDIA : PPR 853F FORM TIME : 58 sec.
CYCLE TIME : 3 min DRY TIME : 140 sec

CAKE ANALYSIS

IDENT : B-12
TARE : 110.11
TARE+WET : 138.70
TARE+DRY : 113.80
% SOLIDS : 12.91

CAKE THICKNESS : 0.3 cm

Filtrate Volume : 93 ml

Sludge Solids

IDENT	TARE+WET	TARE+DRY	TARE	% SOLIDS	$\bar{x}$
67A	21.3760	2.3700	1.3568	5.0611	
68A	22.0645	2.4191	1.3534	5.1455	5.0863%
69A	21.1111	2.3612	1.3635	5.0522	

Filtrate Solids

IDENT	TARE+DRY	TARE	VOLUME	SOLIDS	$\bar{x}$
134	.1750	.1306	25	1776	1786
135	.1756	.1307	25	1796	

mg/l

% Recovery :
Yield :

Oct 17, 79 Vacuum Filtration

FILTER MEDIA : PAR 851 FORM TIME : 58 sec
CYCLE TIME : 3 min DRY TIME : 140 sec.

CAKE ANALYSIS : IDENT : 8 (B-35)
TARE : 102.46
TARE + WET : 122.63
TARE + DRY : 105.37
CAKE THICKNESS : 0.1 in . 2 cm . % SOLIDS : 14.43

Filtrate Volume : 93 mls.

Sludge Solids

5,0863

Filtrate Solids

IDENT	TARE + DRY	TARE	VOLUME	SOLIDS	$\bar{x}$
136	.1795	.1302	25	1972	1964
137	.1784	.1295	25	1956	

mg/l

% Recovery :
YIELD :

Oct 17, 79 Vacuum Filtration - 22" Hg.

FILTER MEDIA: BFR 851 FORM TIME: 19 sec
CYCLE TIME: 1 min. DRY TIME: 13 sec.

CAKE ANALYSIS: IDENT: 9(B-15)
TARE: 105.39
TARE + WET: 120.60
TARE + DRY: 105.33
CAKE THICKNESS: 0 1/2 cm % SOLIDS: 11.27

FILTRATE Volume: 116 mls.

Sludge Solids

5.0863

Filtrate Solids:

IDENT	TARE + DRY	TARE	VOLUME	SOLIDS %
138	.1659	.1232	25	1508

mg/l

% Recovery:
YIELD:

Oct 17, 79 Vacuum Filtration - 22" Hg

FILTER MEDIA: PePR 851 FORM TIME: 96 sec
CYCLE TIME: 5 min DRY TIME: 67 sec.

CAKE ANALYSIS: IDENT: 2(B-9)
TARE: 109.47
TARE + WET: 138.06
TARE + DRY: 113.60
CAKE THICKNESS - 3½-35cm % SOLIDS: 14.44

FILTRATE VOLUME: 115 mls.

Sludge Solids

Filtrate Solids

IDENT	TARE + DRY	TARE	VOLUME	SOLIDS	$\bar{x}$
139	.1435	.1283	25	608	608 mg/l
140	.1429	.1277	25	608	

NOTE ON VACUUM FILTRATION RUNS.

A) CAKE LIKE PASTE ON ALL RUNS + HAD TO BE SCRAPED OFF CLOTHS.
B) CLOTHS PLUGGED EARLY WITH "FINES".
C) FILTRATE IS A YELLOW COLOUR, - (YELLOW FLOC WHICH SETTLES WITH TIME.

Oct 17, 79 Tuco Sample - Vacuum Filter.

FILTER MEDIA: PoPR 851 Form Time = 58 sec
CYCLE TIME: 3 min DRY TIME - 40 sec.

CAKE ANALYSIS: IDENT: 75
TARE: 102.50
TARE+WET: 113.44
TARE+DRY: 105.03
CAKE THICKNESS: 0.1 cm. % SOLIDS: 23.13.

Filtrate Volume: 64 mls.

Sludge Solids

Filtrate Solids

IDENT	TARE+DRY	TARE	VOLUME	SOLIDS	$\bar{x}$
		.1284			
142	.1454	~~.1284~~	25	680	676
143	.1464	.1296	25	672	mg/l

NOTE: A 2.0 L SAMPLE WAS SHOPPED FOR 10 MIN PRIOR TO FILTER LEAF, BUCHNER FUNNEL + CST.

Oct 17, 79 Filter Strength - Buchner Funnel
25 "Hg

CONDITIONING: SHEARED
FEED SOLIDS

9 cm dia Whatman #61
Appx. Vol. of sludge - 200 ml

Wgt of Mfg sludge + graduate	448.97
Wgt of graduate after pouring	246.43
Wgt of Mfg sludge (gms)	202.54

CAKE ANALYSIS:

IDENT:	B-22
TARE:	109.63
TARE + WET:	150.78
TARE + DRY:	119.70
% SOLIDS:	24.47

CAKE THICK: .5 to .55 cm

Filtrate Viscosity: H2O - 100 - M131 t = 1) 64.7 sec
2) 60.5 sec

t (min)	V (ml)	t/v ($\frac{sec}{ml}$)
.5	16	
1.5	31	
2.5	41	
5.0	60	
10.0	88	
15.0	108	
20.0	126	
25.0	131	
30.0	154	
33.4	162	

1" Sat. Pack

Oct 17, 79 Floc Strength

CST Initial prior to shearing

1) 36.3
2) 38.3
3) 37.5

AVER. 37.4 sec.

CST After shearing.

1) 52.8
2) 53.7
3) 55.2

AVER. 53.9 sec

Oct 18, 79 Pressure Filter.

FILTER MEDIA: NY529F
PRESSURE : 75 psig

NOTE: OXYGEN WAS USED ON THIS RUN RATHER THAN COMPRESSED AIR.

Filtrate Flow

A) TIME (min)	B) Vol. (ml)	C) TOTAL (ml)	TIME (min)	Vol. (ml)	TOTAL (ml)
0.0	~5	~5			
1.00	27	27			
5.00	61	61			
10.00	89	89			
—	100	100			
30.00	58	158			
60.00	129	229			
90.00	184	284			
120	233	333			
132.25	250	350			
150.	26	376			
210	103	453			
240	139	489			
300	225	575			
324.6	250	600			
360	34	634			
390	61	661			
415.1	91	691			

see notes on filtrate after next run

FILTRATE SOLIDS – first 100 mls.

IDENT	TARE + DRY	TARE	VOL.	TSS (mg/l)
149	.1338	.1309	50.	58

FILTRATE SOLIDS – remainder

150	.1310	.1285	100	25

FILTRATE SOLIDS – combined

151	.1355	.1294	250	24.4

CAKE SOLIDS :

IDENT	: 9(B-15)
TARE	: 103.38
TARE + WET	: 242.81
TARE + DRY	: 141.29
% SOLIDS	: 27.19

FEED CAKE SOLIDS

IDENT	TARE + WET	TARE + DRY	TARE	% SOLIDS	$\bar{x}$
70A	19.0585	2.7303	1.3614	7.7461	7.7668
71A	20.8681	2.8728	1.3530	7.7878	
72A	23.2955	3.0582	1.3541	7.7666	

Oct 19, 79

Pressure Filter

NOTE: O_2 CYLINDER USED IN PLACE OF COMPRESSED AIR

FILTER MEDIA: POR 859
PRESSURE : 75 PSIG

Filtrate Flow—

TIME (min)	B Vol (ml)	Tot Vol (ml)	
0.0	~3	3	First 20 ml very High IN Solids
1.00	35	35	
2.00	48	48	
3.00	61	61	
5.00	78	78	
8.30	100	100	
30.00	90	190	CARRY over of SOLIDS FROM INITIAL 30 min.
65.00	185	285	
99.50	250	350	
120.00	36	386	
150	71	421	
180	125	476	
240	197	547	
283	250	600	
300	18	618	
330	52	652	
360	83	683	
390	110	710	
3932	130	730	✓

See notes on filtrate

Last 15 ml extremely high in solids, possibly some of the initial solids being blown through.

Filtrate Solids - first 100 mls.

IDENT	TARE + DRY	TARE	VOL.	TSS (mg/l)
155	.2397	.1286	10	11,110

Filtrate Solids - remainder

156	.1798	.1287	70 ml	730

Filtrate Solids - combined

157	.1831	.1289	25	2168

CAKE SOLIDS:

IDENT : B-33
TARE : 103.41
TARE + WET : 221.52
TARE + DRY : 133.74
% SOLIDS : 25.68

FEED SOLIDS

IDENT	TARE + WET	TARE + DRY	TARE	% SOL.	$\bar{x}$
73A	26.4835	3.3527	1.3480	7.7940	8.0095
74A	19.3210	2.5004	1.3505	8.0682	
75A	22.9296	3.1197	1.3581	8.1663	

McLaren Sludge.

Description:

The McLaren sludge is white to beige in colour with a granular appearance. The sludge has flat "chunks" of brown particles as well as red and green particles. Particle size was 1/8 to 1/4" of all types of particles.

The liquid supplied, covers with a gel of 1/2" thick white material after settling for a few minutes.

Red worms were sucked off the surface of the sludge daily prior to use.

The bottom of the samples were very high in small pebbles, enough to cover the bottom of each pail.

The sludge was very similar in appearance to Jeanneville type peb~~le~~ sludge.

SOLIDS

		TOTAL	SUSPENDED
Oct	16	4.1875	39463
	17	5.6387	52883
		5.0863	50020
	18	7.1668	71725

Pressure filter Runs – WT Larsons Sludge

Notes on Filtrate on Runs 1 + 2 with WT. sludge. The filtrate filters clear + ~~~~ turns cloudy (+ forms a precipitate) before the entire volume is filtered through the cloth.

For example, in run # 1, before the run had finished, the 500 mls which was collected after the initial 100 mls, has changed from clear to cloudy, thus giving a TSS value higher than if filtering had been immediate

POOR

QUALITY

ORIGINAL